

Instantaneous Analysis Attribute for Reservoir Characterization at Basin Nova-Scotia, Canada

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Abstract—Analysis of data seismic attributes used in the Basin of Nova-Scotia, Canada. This analysis aimed to determine the distribution of reservoir and reservoir characterization. Seismic attribute used the instantaneous attributes which included instantaneous amplitude, instantaneous frequency and instantaneous phase while for reservoir characterization used crossplot between instantaneous attributes with well log data. The attribute ran on specified target zone, the attribute analysis to determine the distribution of the reservoir. Crossplot conducted to determine the characteristics or physical properties of the reservoir in the target zone. Furthermore, lithologic and stratigraphic analysis to determine the geological conditions of the target zone. The study was conducted in inline and crossline of Logan Canyon formations. Research results obtained in the form of small fractures that are not visible and the two major faults with direction Northwest-Southeast and has the attributes of instantaneous output value is low. This fault is also the location of a distribution reservoir contained in the target zone. For the reservoir characteristics such as porosity and acoustic impedance range of values obtained respectively, so it can be said that the target zone is dominated by a sandstone reservoir form.

Keywords— Instantaneous attributes, reservoir, well log

INTRODUCTION

Of the needs will energy oil and natural gas has been increasing based on outlook energy Indonesia published by the body for and application of technology (bppt) who estimates from year 2011 until 2030 to increase the average energy needs 4.7 % every year [1]. Based on it was done exploration energy oil and natural gas. One he did exploration good knowing information about information on the characteristics of reservoir [2]. Characterization reservoir is a process to describe in and in qualitative or quantitative reservoir characters use all existing data. Intended to know the character or the properties of a reservoir of the nature of fisis and the nature of geometry [3].

Seismic attributes as a mathematical transformation of data seismic tras represent the time, amplitude, phase, frequency, and atenuasi. Attributes seismic in the interpretation seismic needed to show anomalous not seen clearly data on seismic [2]. Seismic attributes can be used for identifying characteristic of visibility reservoir crack distribution of a layers of rock shows the nature of physics, geometry, and certain sediment differently from surrounding [4]. Research conducted of characteristic reservoir crack uses attributes instantaneous with output amplitude, frequency, and phase, the reservoir crack know distribution and characteristic or trait of fisis reservoir crack porosity and acoustic impedance using opendtect software. Performed on regional data exploration penobscot field, canada.

a. Instantaneous Attributes

According to tanner *et al* [5], attributes it includes the one physical, calculated from trace complex $c(t)$ consisting of seismic tras $s(t)$ and transformation hilbertnya $h(t)$, which is shifting the phase of 90° of seismic trace or converting cosine into the function sinus.

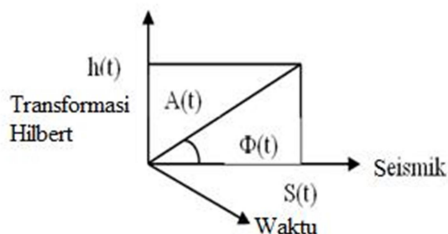


Figure 1. Complex trace

Writing trace complex, as seen in figure 1, giving two basic attribute the strong reflection $A(t)$ and instantaneous phase $\phi(t)$ with imaginary number $i = \sqrt{-1}$.

$$C(t) = s(t) + ih(t) \quad (1)$$

$$C(t) = A(t)e^{i\phi(t)} \quad (2)$$

$$C(t) = A(t) \cos \phi(t) + iA(t) \sin \phi(t) \quad (3)$$

Attributes the third is the frequency of a moment that is derived shortly before the phase. The equation a moment it can be written

$$f(t) = \frac{1}{2\pi} \frac{d\phi(t)}{dt} \quad (4)$$

b. Reservoir Characterization

1. Porosity

Asquith and Gibson [6], of the nature of the rock or characteristic that affects the measurement of logs one of them is of the porosity. The porosity of rock is one of the characteristics of acoustic of reservoir which is defined as rocks the size of the ability to store fluid, expressed in percent (%) or fractions. Mathematically can be rendered as an equation a following with a symbol porosity ϕ , pore volume V , and completely volume V_T that is:

$$\phi = \frac{V}{V_T} \times 100\% \quad (5)$$

2. Acoustic Impedance

Acoustic impedance defined as the rock capability defined as the rock capability to pass seismic waves through which. Acoustic impedance reflect the condition and speed rock density on the characteristics of rocks itself so as to used as an indicator to pass seismic waves through which. Acoustic impedance reflect the condition and speed rock density on the characteristics of rocks itself so as to used as an indicator lithology or porosity rocks. More solid a rock and impedance acoustic b side will be bigger, and vice versa. In fisis, acoustic impedance (IA) was the result of multiplication between speed (v) and density (ρ) that is formulated as the following:

$$IA = \rho v \quad (5)$$

The price of IA was influenced by speed compared with rocks order density for speed value is greater than the value of density order. speed climbing waves will increase as you get kompaksitas rocks, while frequency will be reduced a consequence of the effect atenuasi [2].

METHOD

a. Tools and Data used in research

Research equipment used among others computer memory 8 Gb, operating system 64-bit, and software opendtect v.5.0.9 2d/3d. The data used the research is regional data exploration penobscot field, Canada consisting of data seismic, data logs well, data marker, and data checkshot.

b. Procedure Research

Researched process is preparation data and data processing. Preparation data that is prepared the data used, in the form of wells and seismic data. In data processing, the data then input in software used and processed to well seismic tie to get correlation between the data on seismic

and data well. Next, determine target zones having anomalous hydrocarbon, for example brightspot and faulting, and applied attribute instantaneous in the target zones. Obtained map attributes then analysis and was conducted crossplot between attribute with log entry well, so that obtainable characteristic reservoir of porosity and acoustic impedance which then a conclusion can be drawn with some the analysis.

RESULTS AND DISCUSSION

The results of research showed that is can be seen from analysis have included :

1. Attributes instantaneous analysis

The results of the map attribute instantaneous that there is fault on target zones seems clearly with the northwest-southeastern. Fault they are also the of distribution reservoir very dominated. Fault and distribution reservoir on target zones by the application of attribute instantaneous having value output amplitude, frequency, and phase low. This, to the fault shallow or close to the surface so that the waves of also fast.

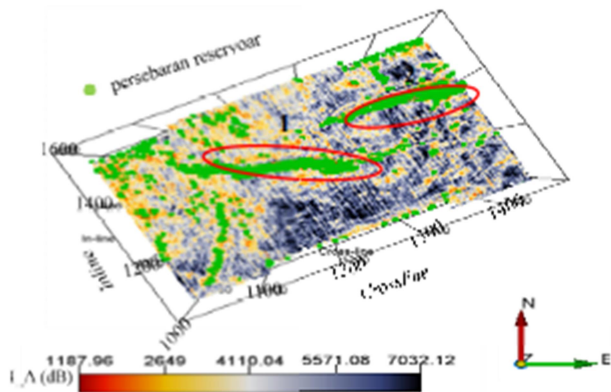


Figure 2. The fault and distribution reservoir

2. Analysis crossplot attributes instantaneous with the data logs well

The process of analysis of the attributes instantaneous crossplot with the data logs well done after knowing the location of the fault and reservoir crack spreads to acquire values characteristic reservoir, in this form of porosity and acoustic impedance and also know the relationship between attribute instantaneous against porosity and acoustic impedance.

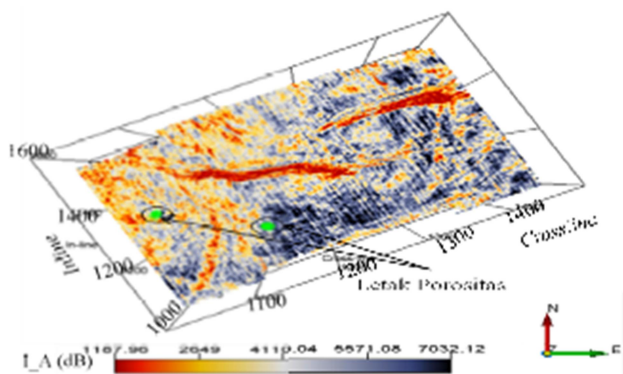


Figure 3. The porosity on a map attributes instantaneous

Done crossplot attribute instantaneous and log wells to know the nature of fisis relations (porosity and acoustic impedance) reservoir with attribute instantaneous and also to determine the value of porosity and acoustic impedance .The following is the result and the permanent crossplot porosity being indicated by the color green dots on logan canyon formation. The bigger porosity, the less acoustic impedance and the less amplitude obtained. This, because a possible mixing a reservoir [7].

3. Analysis the results of distribution and characteristic of reservoir about the condition of geology

Based on an analysis that has been done, so the results that can be adjusted to information formation it is in the field exploration. Known that the magnitude of its porosity obtained 15 % and 22 % that allows reservoir that is on the logan canyon dominated by sandstone. The acoustic impedance have a value $>12500 \text{ ft/s} \cdot \text{g/cc}$ who also allows there are sandstone in the layers.

CONCLUSION

Conclusion to research have included, obtained distribution reservoir on target zones scattered on anomalous fault with the northwest-southeastern in the southwest and northeastern. Reservoir scattered on target zones influenced by the instantaneous amplitude, frequency, and phase. Characteristic fisis reservoir based on porosity that is obtained value of 15% - 22% in target zones, where by the span of the value of porosity having a scale good enough to a reservoir. Value acoustic impedance obtained of more than $12500 \text{ ft/s} \cdot \text{g/cc}$. Values characteristic reservoir obtained at the target zones possible is the dominated by sandstone.

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